



To: Benjamin Avery
Riverside Partners, LLC

Date: January 31, 2020

Project #: 58036.00

From: Jenn Conley, PE
Erica Quallen

Re: Riverside Independent Living
Traffic Impact Study
Burlington, VT

VHB has conducted a Traffic Impact Study (TIS) for the proposed Riverside Independent Living facility to be located at 362-374 Riverside Avenue, with access from Hillside Terrace in Burlington, Vermont.

The proposed facility will have approximately 60 units and is located on the southern side of Riverside Avenue between the loop ends of Hillside Terrace, with the access and egress point being adjacent to the westernmost intersection of Hillside Terrace and Riverside Avenue.

This Traffic Impact Study includes the following elements:

- A description of the existing roadway network in the vicinity of the site;
- A summary of the crash data within the study area;
- A description of the proposed development program;
- A trip generation estimate for the proposed development program;
- An evaluation of anticipated traffic changes for the adjacent roadway and intersections in the vicinity;
- An evaluation of traffic operations within the study area; and
- Conclusions and recommendations to support the project.

As part of this study, three different intersections were evaluated and summarized in regard to level of service (LOS) and average delay in order to estimate how the proposed project impacts the local street network. The traffic study intersections are shown in **Figure 1**.

EXISTING CONDITIONS

The project is located on Hillside Terrace, specifically on the northwest segment of the loop. Hillside Terrace is a loop road with both ends connecting to Riverside Avenue. The driveway for the proposed redevelopment is located approximately 125-feet from the west intersection of Riverside Avenue and Hillside Terrace. The location of the site in relation to the local roadway network is shown in **Figure 1**.

Figure 1: Sie Location Map



Roadway Characteristics

Hillside Terrace is a residential loop road providing access to the homes on Hillside Terrace as well as one adjacent housing development. Hillside Terrace connects on both sides to Riverside Avenue forming intersections approximately 300-feet apart along Riverside Avenue. The western intersection is an unsignalized intersection with Hillside Terrace operating under stop-control. The eastern intersection is signalized with Hillside Terrace being an actuated approach. Hillside Terrace provides sidewalks on the inner side of the loop which connect to sidewalks on Riverside Avenue.

Riverside Avenue serves as a segment of US Routes 2 and 7 and is an east-west principal arterial that parallels the Winooski River, connecting Burlington's Old North End neighborhood to downtown Winooski. In the vicinity of the project site, it is a 25 mile per hour roadway carrying between 15,000 and 16,000 vehicles per day¹.

SAFETY ASSESSMENT

A review of VTrans' most recent High Crash Location (HCL) Report (2012-2016) revealed no roadway segments or intersections within the project study area classified as an HCL by VTrans². In addition, the VTrans Public Crash Data Query Tool was reviewed to investigate project area crashes for the most recent 5-year period available: January 1, 2014 through December 31, 2018. **Table 1** below summarizes the reported crashes for the primary study area over the recent five-year period. Additional detail of the crashes is included in the Appendix.

Table 1: Summary of 2014-2018 Reported Crashes

Location	Number of Crashes	Injury Crashes	Fatal Crashes	Property Damage Only	Rear End Crashes	Turning Vehicle Crashes	Wet/Snowy Road Conditions
Riverside Avenue and Hillside Terrace	25	7 (28%)	0	18 (72%)	10 (40%)	5 (20%)	5 (20%)

TRAFFIC NETWORKS

Seasonal Variation

Since it is impractical to design for the highest volume encountered during the year, VTrans guidelines recommend a compromise between capacity and cost. Design Hourly Volume (DHV) criteria allow roads to be designed for the 30th highest hourly volume of the year. VTrans Riverside Avenue Average Annual Daily Traffic (AADT) traffic volume data was obtained. The appropriate VTrans DHV adjustment factors for volumes and roadway type were researched and applied to the AADT.³ Detailed calculations for the DHV adjustments are provided in the Appendix.

Background Growth

Background traffic growth is a function of expected land development in the region. To predict a rate at which traffic can be expected to grow during the forecast period, historical traffic growth was examined. The regression analysis chart in the 2017 VTrans Redbook⁴ suggests a background growth rate of 1.03 for projecting traffic volumes from 2020 to 2025. VTrans regression analysis is provided in the Appendix.

¹ Vermont Agency of Transportation Highway Division Traffic Research Unit, 2018 (Route Log) AADTs: State Highways. May 2019.

² [High Crash Location Report: Intersections and Segments \(2012-2016\)](#), Vermont Agency of Transportation Office of Highway Safety Division.

³ ATR Station D156

⁴ Continuous Traffic Counter Report (The Redbook), Vermont Agency of Transportation, 2017.

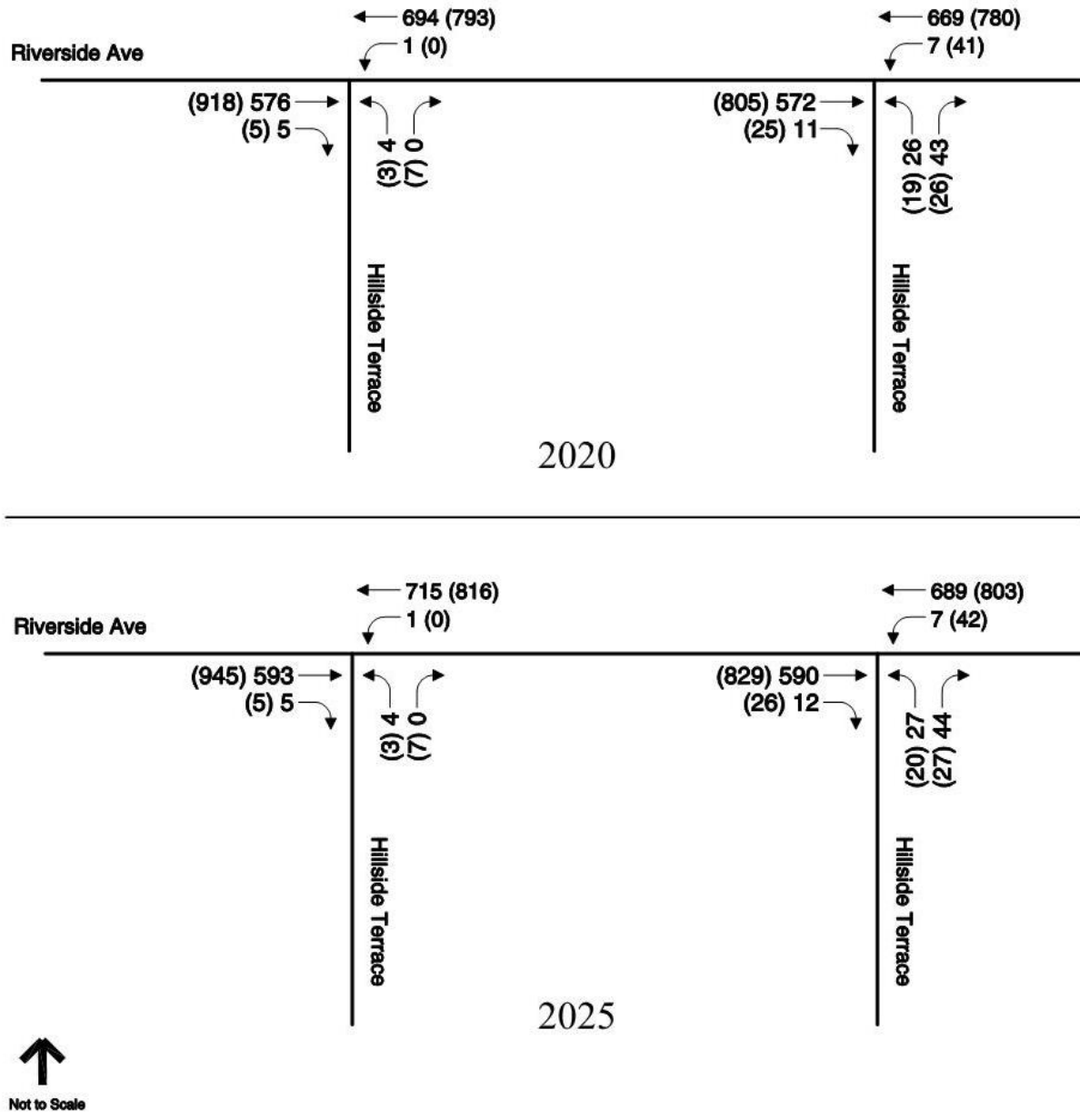
Other Development

Based on review of proposed developments in the vicinity of the project site, one project undergoing the Burlington Design Review Board process was found that was included in the background traffic volumes for this project. A housing development at 110 Riverside Avenue is being proposed and is anticipated to generate 21 weekday AM peak hour trips and 26 weekday PM peak hour trips. The trip distribution shown in the Trudell Consulting Engineers November 2019 traffic analysis was used to add these trips to the network being analyzed in this traffic analysis. A copy of the relevant data from the Trudell study can be found in the Appendix.

No Build Traffic Networks

The 2020 and 2025 No Build traffic volumes were developed by applying the growth factors from the VTrans regression analysis chart to DHV-adjusted peak hour traffic volumes and adding the other identified project traffic. The 2020 and 2025 No Build weekday AM and PM volumes are shown in **Figure 2**.

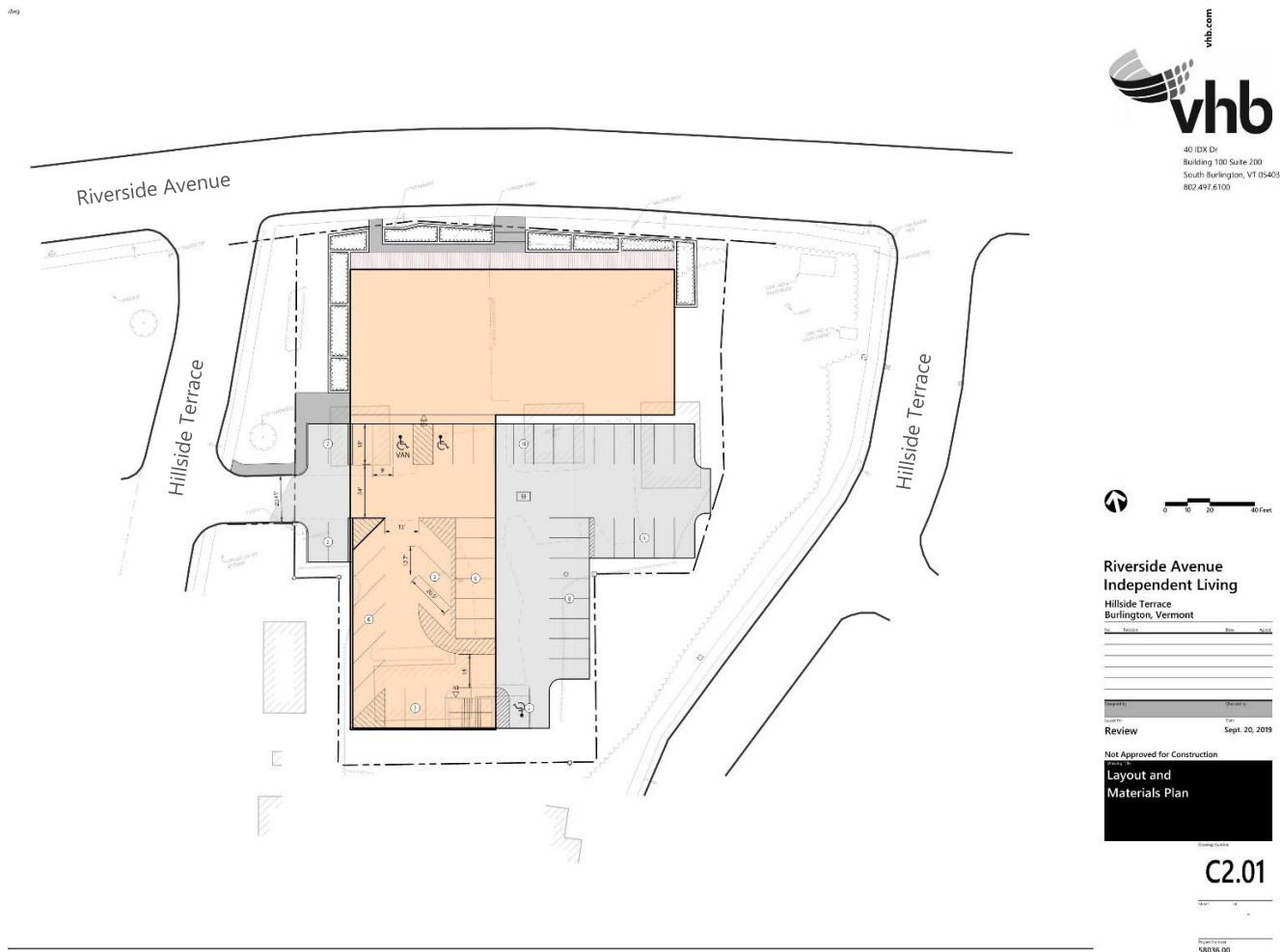
Figure 2: 2020 and 2025 No Build Traffic Volumes



PROPOSED DEVELOPMENT

The proposed facility will have approximately 60 independent living residential units and is located on the southern side of Riverside Avenue between the loop ends of Hillside Terrace, with the access and egress point being adjacent to the western intersection of Hillside Terrace and Riverside Avenue. The proposed layout of the project site is shown below in **Figure 3**.

Figure 3: Proposed Site Plan



TRIP GENERATION

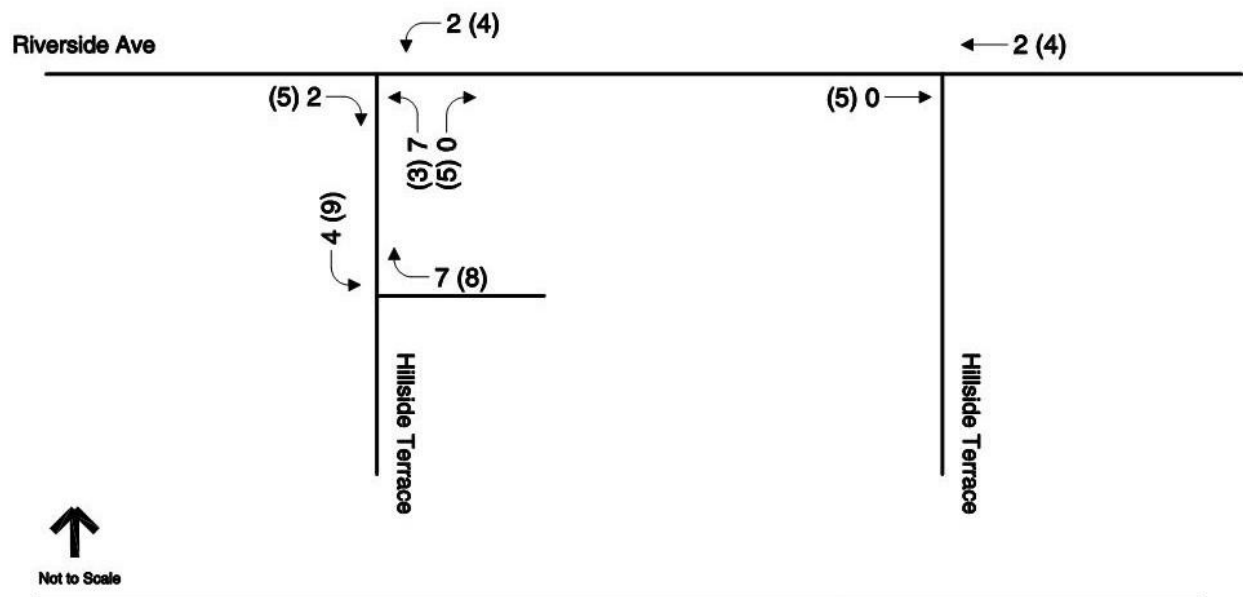
Trip estimates for the proposed development were calculated based on rates published by the Institute of Transportation Engineers (ITE) in the 10th edition of the Trip Generation Manual for the weekday AM and PM peak hours. These time periods are typically the highest volume times on the adjacent roadway network and are used for this analysis. ITE land use code (LUC) 252 – Senior Adult Housing, Attached was used to estimate peak hour

trips of the proposed development. Based on ITE estimates, the independent living facility would be expected to generate 12 trips during the weekday AM peak hour and 17 vehicle trips during the PM peak hour. **Table 2** summarizes the trip generation estimate for the proposed development. The distribution of these trips onto the roadway network was based on current travel patterns and is shown in **Figure 4**.

Table 2: Trip Generation Summary

Peak Period	Total Peak Hour Site Generated Trips
<i>Weekday AM</i>	
Enter	4
Exit	8
Total	12
<i>Weekday PM</i>	
Enter	9
Exit	8
Total	17

Figure 4: Site Generated Trip Distribution



Legend
 AM Peak Hour
 (PM Peak Hour)

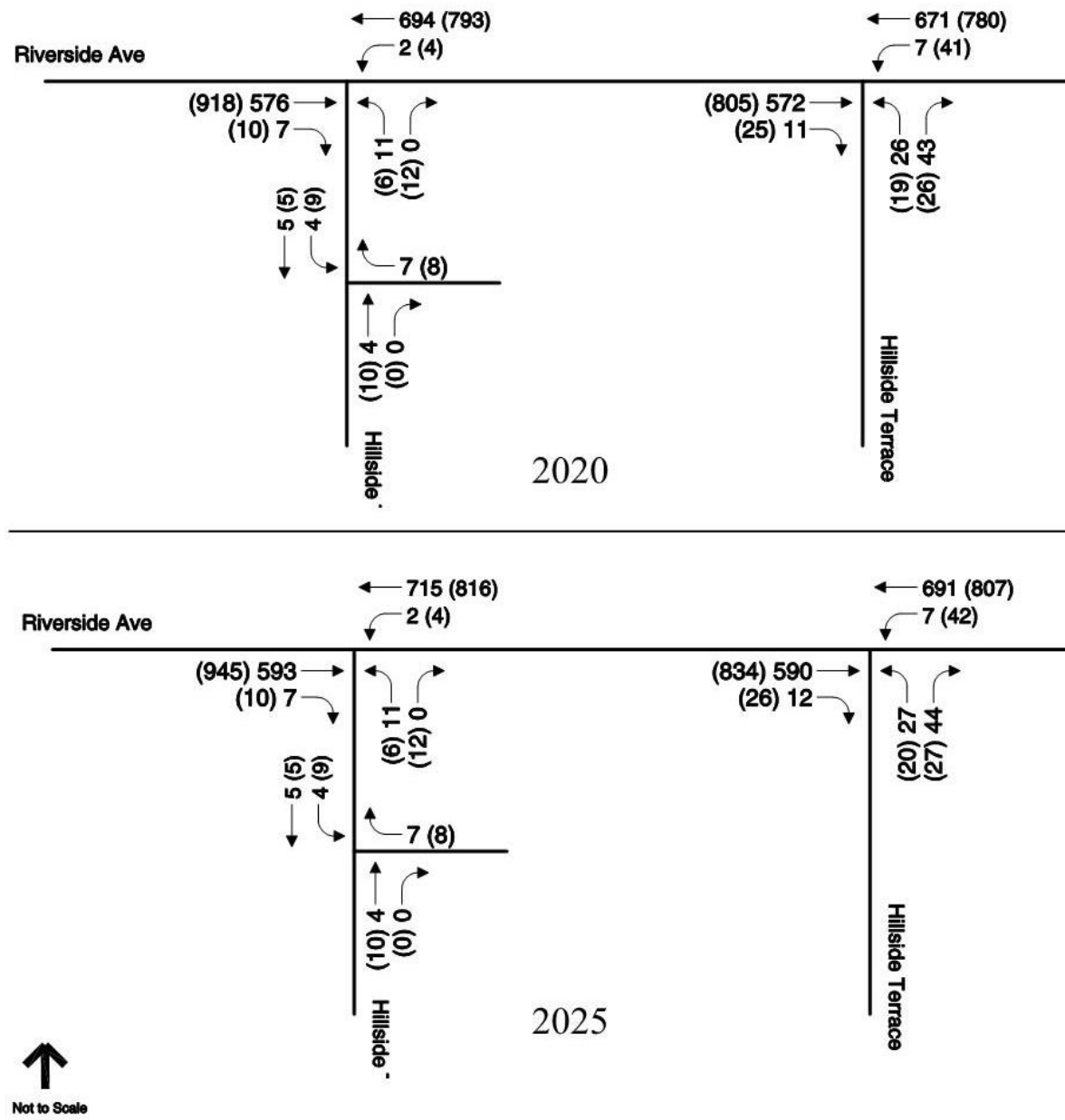


Figure 4
 Site Generated Trips
 Peak Hour Traffic Volumes

Build Traffic Networks

The 2020 and 2025 Build traffic volumes were developed by combining the No Build volumes and site generated trips. The 2020 and 2025 Build weekday AM and PM volumes are shown in **Figure 2**.

Figure 5: 2020 and 2025 Build Traffic Volumes



TRAFFIC ANALYSES

Intersection capacity analyses were performed for the study area intersections. Levels of service (LOS) were calculated based on the criteria published in the *2000 Highway Capacity Manual*.⁵ Level of service is the term that defines the conditions that may occur on a given roadway or at an intersection when accommodating various traffic volume loads. Levels of service range from A to F with LOS A representing generally free flowing operating conditions and LOS F representing generally congested conditions. Copies of the LOS calculations are provided in the Appendix.

Table 3 summarizes the operational analysis at the *unsignalized* study area intersection during the 2020 and 2025 weekday AM and PM peak hours under No Build and Build conditions. As shown in the table, Hillside Terrace West at Riverside Avenue experiences only two to five second increases in delay from the No Build to Build scenarios in both peak hours. LOS E is typically regarded as a deficient level of service, but it should be noted that the volume to capacity ratio is only 0.14 in the Build scenario is just over the threshold of 35 seconds of delay to be defined as LOS E. The major approach will operate at LOS A as it continues to experience free-flow conditions. The unsignalized intersection of Hillside Terrace and the site driveway will operate at LOS A from all approaches, in all conditions.

Table 4 summarizes the operational analysis at the *signalized* study area intersections during the 2020 and 2025 weekday AM and PM peak hours under No Build and Build conditions. As shown in the table, the signalized intersection of Hillside Terrace East and Riverside Avenue is expected to operate overall at LOS C or better in 2020 and 2025 both without and with the project. Project related delays are expected to be less than one second per vehicle. Overall the results indicate that the infrastructure has been built to accommodate the growth anticipated in this area.

Table 3: Unsignalized Intersection Capacity Analysis

Intersection / Movement		2020 No Build			2020 Build			2025 No Build			2025 Build		
		v/c*	Delay*	LOS**	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay*	LOS**
AM Peak Hour	Hillside Terrace West at Riverside Ave												
	EB from Riverside Ave	0.34	0.0	A	0.34	0.0	A	0.35	0.0	A	0.35	0	A
	WB from Riverside Ave	0.00	0.0	A	0.00	0.1	A	0.00	0.0	A	0.00	0.1	A
	NB from Hillside Terrace	0.03	28.5	D	0.07	30.0	D	0.03	30.5	D	0.08	32.2	D
	Hillside Terrace West at Site Driveway												
	WB from Site Driveway	DOES NOT EXIST IN NO BUILD CONDITION			0.01	8.4	A	DOES NOT EXIST IN NO BUILD CONDITION			0.01	8.4	A
	NB from Hillside Terrace				0.00	0.0	A				0.00	0.0	A
	SB from Hillside Terrace				0.00	3.2	A				0.00	3.2	A
PM Peak Hour	Hillside Terrace West at Riverside Ave												
	EB from Riverside Ave	0.54	0.0	A	0.55	0.0	A	0.56	0.0	A	0.56	0.0	A
	WB from Riverside Ave	0.00	0.0	A	0.01	0.1	A	0.00	0.0	A	0.01	0.2	A
	NB from Hillside Terrace	0.07	32.0	D	0.14	36.7	E	0.08	35.4	E	0.15	40.4	E
	Hillside Terrace West at Site Driveway												
	WB from Site Driveway	DOES NOT EXIST IN NO BUILD CONDITION			0.01	8.4	A	DOES NOT EXIST IN NO BUILD CONDITION			0.01	8.4	A
	NB from Hillside Terrace				0.01	0.0	A				0.01	0.0	A
	SB from Hillside Terrace				0.01	4.7	A				0.01	4.7	A

* Volume to capacity ratio

* Delay expressed in seconds per vehicle

** Level of Service

⁵ Highway Capacity Manual, Federal Highway Administration, Transportation Research Board, 2000.

Table 4: Signalized Intersection Capacity Analysis

Intersection / Movement		2020 No Build			2020 Build			2025 No Build			2025 Build		
		v/c [*]	Delay [*]	LOS ^{**}	v/c	Delay	LOS	v/c	Delay	LOS	v/c [*]	Delay [*]	LOS ^{**}
AM Peak Hour	Hillside Terrace East at Riverside Ave												
	EB from Riverside Ave	0.50	10.3	B	0.50	10.3	B	0.51	10.5	B	0.51	10.5	B
	WB Left Turn from Riverside Ave	0.02	6.1	A	0.02	6.1	A	0.02	6.1	A	0.02	6.1	A
	WB Through from Riverside Ave	0.57	10.1	B	0.57	10.1	B	0.59	10.3	B	0.59	10.4	B
	NB from Hillside Terrace	0.11	30.7	C	0.11	30.7	C	0.11	30.8	C	0.11	30.8	C
	Overall	0.45	11.2	B	0.45	11.3	B	0.46	11.5	B	0.47	11.5	B
PM Peak Hour	Hillside Terrace East at Riverside Ave												
	EB from Riverside Ave	0.71	14.6	B	0.71	14.7	B	0.73	15.3	B	0.74	15.4	B
	WB Left Turn from Riverside Ave	0.17	7.1	A	0.17	7.1	A	0.19	7.2	A	0.19	7.3	A
	WB Through from Riverside Ave	0.67	11.8	B	0.67	11.9	B	0.69	12.3	B	0.69	12.4	B
	NB from Hillside Terrace	0.08	30.3	C	0.08	30.3	C	0.08	30.3	C	0.08	30.3	C
	Overall	0.55	13.6	B	0.55	13.7	B	0.57	14.1	B	0.57	14.2	B

^{*} Volume to capacity ratio

^{*} Delay expressed in seconds per vehicle

^{**} Level of Service

CONCLUSIONS

The proposed project consists of constructing a new 60-unit Independent Living at 362-374 Riverside Avenue, with access from Hillside Terrace in Burlington, Vermont. The trip generation estimates conducted for this study indicate that the proposed development program will generate approximately 12 new vehicle trips during the weekday AM peak hour and 17 new vehicle trips during the weekday PM peak hour.

Primary access and egress will be provided via the existing residential access off Hillside Terrace which has experienced no reported crash history and is not expected to decrease in safety with the addition of this driveway. A LOS E is expected from the Hillside Terrace West approach at Riverside Avenue, but the proposed development is not likely to increase delay by more than five seconds compared to the No Build scenario. The project related delay increases are less than two seconds per vehicle at each of the study area intersections.

In conclusion, based on the results of this Traffic Impact Study, the proposed Independent Living facility project is not anticipated to generate unreasonable congestion or unsafe conditions on the adjacent roadway network.

Appendices

- A. Traffic Volume Data
- B. Crash Data
- C. Trip Generation Summary
- D. 110 Riverside Avenue Traffic Impact Analysis
- E. Intersection Capacity Analysis



Appendix A

Traffic Volume Data

TURNING MOVEMENT COUNT DATA - Totals by Movement

PEAK HOUR CALCULATIONS

	Start Time	SB N/A				WB Riverside Ave				NB Hillside Terrace				EB Riverside Ave				1 HR TOTALS					
		Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Begin Time	SB	WB	NB	EB	TOTAL
1	06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	06:00 AM	0	0	0	102	102
2	06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	06:15 AM	0	97	0	217	314
3	06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	06:30 AM	0	245	0	366	611
4	06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	102	0	0	06:45 AM	0	400	1	519	920
5	07:00 AM	0	0	0	0	0	97	0	0	0	0	0	1	0	115	0	0	07:00 AM	0	586	3	563	1152
6	07:15 AM	0	0	0	0	0	148	0	0	0	0	0	1	1	148	0	0	07:15 AM	0	662	3	584	1249
7	07:30 AM	0	0	0	0	1	154	0	0	0	0	1	1	2	151	0	0	07:30 AM	0	677	4	570	1251
8	07:45 AM	0	0	0	0	0	186	0	0	0	0	2	0	1	145	0	0	07:45 AM	0	669	4	576	1249
9	08:00 AM	0	0	0	0	0	173	0	0	0	0	0	1	1	135	0	0	08:00 AM	0	662	3	436	1101
10	08:15 AM	0	0	0	0	0	163	0	0	0	0	1	1	1	134	0	0	08:15 AM	0	489	3	300	792
11	08:30 AM	0	0	0	0	0	147	0	0	0	0	1	2	1	158	0	0	08:30 AM	0	326	2	165	493
12	08:45 AM	0	0	0	0	0	179	0	0	0	0	1	2	1	5	0	0	08:45 AM	0	179	1	6	186
13	09:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	09:00 AM	0	0	0	0	0
14	09:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	09:15 AM	0	0	0	0	0
15	09:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	09:30 AM	0	0	0	0	0
16	09:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	09:45 AM	0	0	0	0	0
17	10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10:00 AM	0	0	0	0	0
18	10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10:15 AM	0	0	0	0	0
19	10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10:30 AM	0	0	0	0	0
20	10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10:45 AM	0	0	0	0	0
21	11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11:00 AM	0	0	0	0	0
22	11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11:15 AM	0	0	0	0	0
23	11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11:30 AM	0	0	0	0	0
24	11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11:45 AM	0	0	0	0	0
25	12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12:00 PM	0	0	0	0	0
26	12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12:15 PM	0	0	0	0	0
27	12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12:30 PM	0	0	0	0	0
28	12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12:45 PM	0	0	0	0	0
29	01:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	01:00 PM	0	0	0	0	0
30	01:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	01:15 PM	0	0	0	0	0
31	01:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	01:30 PM	0	0	0	0	0
32	01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	01:45 PM	0	0	0	0	0
33	02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	02:00 PM	0	0	0	0	0
34	02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	02:15 PM	0	0	0	0	0
35	02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	02:30 PM	0	0	0	0	0
36	02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	02:45 PM	0	0	0	0	0
37	03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	03:00 PM	0	0	0	0	0
38	03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	03:15 PM	0	166	0	169	335
39	03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	03:30 PM	0	327	4	343	674
40	03:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	03:45 PM	0	512	10	551	1073
41	04:00 PM	0	0	0	0	0	165	1	0	0	0	0	0	0	169	0	0	04:00 PM	0	704	11	788	1503
42	04:15 PM	0	0	0	0	0	159	2	0	2	0	2	1	5	169	0	0	04:15 PM	0	731	14	830	1575
43	04:30 PM	0	0	0	0	0	185	0	0	4	0	2	3	1	207	0	0	04:30 PM	0	776	10	901	1687
44	04:45 PM	0	0	0	0	0	192	0	0	1	0	0	4	2	235	0	0	04:45 PM	0	776	6	854	1636
45	05:00 PM	0	0	0	0	0	193	0	0	2	0	1	3	1	210	0	0	05:00 PM	0	759	6	767	1532
46	05:15 PM	0	0	0	0	0	206	0	0	0	0	0	1	1	244	0	0						
47	05:30 PM	0	0	0	0	0	183	2	0	2	0	0	0	1	160	0	0						
48	05:45 PM	0	0	0	0	0	175	0	0	1	0	0	4	1	149	0	0						

Cell ref.: 7
AM Peak Hr
07:30 AM - 8:30 AM
Vol. = 1251

Cell ref.: 43
PM Peak Hr
04:30 PM - 5:30 PM
Vol. = 1687

TURNING MOVEMENT COUNT DATA - Totals by Movement

PEAK HOUR CALCULATIONS

	Start Time	SB N/A				WB Riverside Ave				NB Hillside Terrace				EB Riverside Ave				1 HR TOTALS					
		Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Begin Time	SB	WB	NB	EB	TOTAL
1	06:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	06:00 AM	0	0	0	107	107
2	06:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	06:15 AM	0	95	10	218	323
3	06:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	06:30 AM	0	236	24	370	630
4	06:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	107	0	0	06:45 AM	0	382	45	524	951
5	07:00 AM	0	0	0	0	0	95	0	0	6	0	4	1	0	111	0	0	07:00 AM	0	565	58	566	1189
6	07:15 AM	0	0	0	0	0	141	0	0	6	0	8	0	0	152	0	0	07:15 AM	0	634	66	589	1289
7	07:30 AM	0	0	0	0	0	146	0	0	14	0	7	1	1	153	0	0	07:30 AM	0	658	68	573	1299
8	07:45 AM	0	0	0	0	0	181	2	2	9	0	4	0	3	146	0	2	07:45 AM	0	656	57	581	1294
9	08:00 AM	0	0	0	0	0	162	2	2	9	0	9	1	4	130	0	0	08:00 AM	0	648	63	437	1148
10	08:15 AM	0	0	0	0	0	162	3	3	10	0	6	1	3	133	0	0	08:15 AM	0	484	45	303	832
11	08:30 AM	0	0	0	0	0	142	2	2	5	0	5	3	5	157	0	0	08:30 AM	0	319	29	167	515
12	08:45 AM	0	0	0	0	0	172	3	3	12	0	7	0	1	4	0	0	08:45 AM	0	175	19	5	199
13	09:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	09:00 AM	0	0	0	0	0
14	09:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	09:15 AM	0	0	0	0	0
15	09:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	09:30 AM	0	0	0	0	0
16	09:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	09:45 AM	0	0	0	0	0
17	10:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10:00 AM	0	0	0	0	0
18	10:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10:15 AM	0	0	0	0	0
19	10:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10:30 AM	0	0	0	0	0
20	10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10:45 AM	0	0	0	0	0
21	11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11:00 AM	0	0	0	0	0
22	11:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11:15 AM	0	0	0	0	0
23	11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11:30 AM	0	0	0	0	0
24	11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11:45 AM	0	0	0	0	0
25	12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12:00 PM	0	0	0	0	0
26	12:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12:15 PM	0	0	0	0	0
27	12:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12:30 PM	0	0	0	0	0
28	12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12:45 PM	0	0	0	0	0
29	01:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	01:00 PM	0	0	0	0	0
30	01:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	01:15 PM	0	0	0	0	0
31	01:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	01:30 PM	0	0	0	0	0
32	01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	01:45 PM	0	0	0	0	0
33	02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	02:00 PM	0	0	0	0	0
34	02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	02:15 PM	0	0	0	0	0
35	02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	02:30 PM	0	0	0	0	0
36	02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	02:45 PM	0	0	0	0	0
37	03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	03:00 PM	0	0	0	0	0
38	03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	03:15 PM	0	175	12	176	363
39	03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	03:30 PM	0	339	20	350	709
40	03:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	03:45 PM	0	537	34	562	1133
41	04:00 PM	0	0	0	0	0	165	10	0	7	0	5	0	7	169	0	1	04:00 PM	0	734	44	802	1580
42	04:15 PM	0	0	0	0	0	158	6	0	4	0	4	1	4	170	0	0	04:15 PM	0	761	41	834	1636
43	04:30 PM	0	0	0	0	0	185	13	0	10	0	4	2	5	207	0	0	04:30 PM	0	803	45	810	1658
44	04:45 PM	0	0	0	0	0	190	7	1	7	0	3	2	3	237	0	2	04:45 PM	0	798	40	765	1603
45	05:00 PM	0	0	0	0	0	191	11	0	6	0	3	2	8	200	0	0	05:00 PM	0	784	42	674	1500
46	05:15 PM	0	0	0	0	0	197	9	0	3	0	9	1	9	141	0	0						
47	05:30 PM	0	0	0	0	0	185	8	2	6	0	3	0	6	161	0	0						
48	05:45 PM	0	0	0	0	0	171	12	0	3	0	9	3	10	139	0	2						

Cell ref.: 7
AM Peak Hr
07:30 AM - 8:30 AM
Vol. = 1299

Cell ref.: 43
PM Peak Hr
04:30 PM - 5:30 PM
Vol. = 1658



Computations - AM Peak Hour Vols

Project: 58036.00
Calculated by: ELQ
Checked by: JC

Location: Burlington, VT
Date: 12/11/2019
Date: 1/6/2020

design year 1: 2020
design year 2: 2025

Build Year Growth Factor: 1.03

Enter: 4
Exit: 7

	Unadjusted Data			110 Riverside Ave Trip Generation			2020 AM No Build			Trip Generation	
* underlined roadway is N/S	1: Hillside Terrace West / Site Driveway			1: Hillside Terrace West / Site Driveway			1: Hillside Terrace West / Site Driveway			1: Hillside Terrace West / Site Driveway	
1 Hillside Terrace West / Site Driveway	L	EB WB NB SB	same as PM	L	EB WB NB SB	0	L	EB WB NB SB	9	L	EB WB NB SB
	T	4 5		T	0 0 0 0		T	0 0 0 0		T	4 7
	R			R	0 0 0 0		R	0 0 0 0		R	7 0
	Enter	0 0 4 5		Enter	0 0 0 0		Enter	0 0 4 5		Enter	0 7 0 4
	Exit	0 0 4 5		Exit	0 0 0 0		Exit	0 0 4 5		Exit	4 0 7 0
	% Trucks			% Trucks			% Trucks	0%		% Trucks	
	Peds			Peds	0 0 0 0		Peds	0 0 0 0		Peds	0 0 0 0
	Peak Hour	PHF		Total Adjut:	1.015		Peak Hour	PHF		Total Adjut:	1.015
2: Hillside Terrace West / Riverside Ave			2: Hillside Terrace West / Riverside Ave			2: Hillside Terrace West / Riverside Ave			2: Hillside Terrace West / Riverside Ave		
2 Hillside Terrace West / Riverside Ave Tuesday, July 16, 2019	L	EB WB NB SB	same as PM	L	EB WB NB SB	10	L	EB WB NB SB	1280	L	EB WB NB SB
	T	0 0 4 0		T	0 0 4 0		T	0 0 4 0		T	2 8
	R	565 676 0 0		R	576 694 0 0		R	5 1 0 0		R	2 8
	Enter	5 1 0 0		Enter	581 695 4 0		Enter	2 2 7 0		Enter	2 2 7 0
	Exit	570 677 4 0		Exit	576 698 1 5		Exit	0 7 0 4		Exit	0 7 0 4
	% Trucks	565 680 1 5		% Trucks	0%		% Trucks	0%		% Trucks	
	Peds	3% 4% 0% 0%		Peds	0 0 3 0		Peds	0 0 3 0		Peds	
	Peak Hour	PHF		Total Adjut:	1.015		Peak Hour	PHF		Total Adjut:	1.015
3: Hillside Terrace East / Riverside Ave			3: Hillside Terrace East / Riverside Ave			3: Hillside Terrace East / Riverside Ave			3: Hillside Terrace East / Riverside Ave		
3 Hillside Terrace East / Riverside Ave Tuesday, July 16, 2019 7:30 - 8:30 AM	L	EB WB NB SB	same as PM	L	EB WB NB SB	10	L	EB WB NB SB	1329	L	EB WB NB SB
	T	0 7 26 0		T	0 7 26 0		T	0 7 26 0		T	0 2 0 0
	R	562 651 0 0		R	572 669 0 0		R	11 0 43 0		R	2 0 0 0
	Enter	11 0 42 0		Enter	584 676 69 0		Enter	0 2 0 0		Enter	0 2 0 0
	Exit	573 658 68 0		Exit	615 695 0 18		Exit	0 2 0 0		Exit	
	% Trucks	604 677 0 18		% Trucks	2% 2% 1% 0%		% Trucks	2 7 3 0		% Trucks	
	Peds	2% 2% 1% 0%		Peds	2 7 3 0		Peds			Peds	
	Peak Hour	PHF		Total Adjut:	1.015		Peak Hour	PHF		Total Adjut:	1.015



Computations - AM Peak Hour Vols

Project: 58036.00
Calculated by: ELQ
Checked by: JC

Location: Burlington, VT
Date: 43810
Date: 43836

	2020 AM Build	2025 AM No Build	2025 AM Build																																																																																																																																																																		
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Computations - PM Peak Hour Vols

Project: 58036.00
Calculated by: ELQ
Checked by: JC

Location: Burlington, VT
Date: 12/11/19
Date: 1/6/20

Design Year 1: 2020
Design Year 2: 2025

Build Year Growth Factor: 1.03

Enter: 9
Exit: 8

Unadjusted Data						110 Riverside Ave Trip Generation						2020 PM No Build						Trip Generation																
* underlined roadway is N/S																																		
1: Hillside Terrace West / Site Driveway																																		
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R		896	776	0	0	R	896		776	0	0	R	896	776		0	0	R	896	776	0		0	R	896	776	0		0					
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Exit		901	776	10	0	1687	Exit		901	776	10	0	1687	Exit		901	776	10	0	1687	Exit		901	776	10	0	1687		Exit	901	776	10	0	1687
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	T	0	40	19	0	T		0	40	19	0	T	0		40	19	0	T	0	40		19	0	T	0	40	19	0		T	0	40	19	0
	R	785	763	0	0	R		785	763	0	0	R	785		763	0	0	R	785	763		0	0	R	785	763	0	0		R	785	763	0	0
	Enter	25	0	26	0	1658		Enter	25	0	26	0	1658		Enter	25	0	26	0	1658		Enter	25	0	26	0	1658	Enter		25	0	26	0	1658
	Exit	810	803	45	0	1658		Exit	810	803	45	0	1658		Exit	810	803	45	0	1658		Exit	810	803	45	0	1658	Exit		810	803	45	0	1658
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Project: 58036.00
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Location: Burlington, VT
Date: 12/11/19
Date: 1/6/20

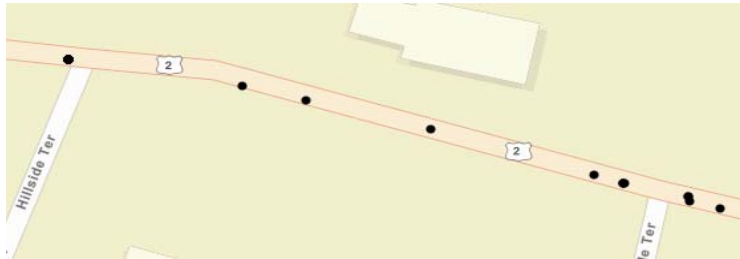
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Appendix B

Crash Data

Riverside Avenue Crash Data



ObjectID	Crash Date	Address	Crash Type	Collision Direction	Weather	Intersection With	Road Characteristics	Surface Condition
121245	April 4, 2014, 8:28 AM	US-7 Riverside Ave	Property Damage Only	Other - Explain in Narrative	Clear	Hildred Dr	Four-way Intersection	Dry
114907	June 6, 2014, 4:57 PM	Riverside Ave	Property Damage Only	Rear End	Clear	Hillside Ter	T - Intersection	Dry
115699	June 16, 2014, 4:36 PM	Riverside Ave	Property Damage Only	Rear End	Clear	Hillside Terr	Not at a Junction	Dry
112252	July 14, 2014, 5:31 PM	US-7 Riverside Ave	Property Damage Only	Rear End	Rain	Hildred Dr	T - Intersection	Wet
115238	August 22, 2014, 5:51 PM	Riverside Ave	Injury	Rear End	Clear	Hillside Terr	T - Intersection	Dry
114077	November 2, 2014, 3:29 PM	Hillside Ter	Property Damage Only	No Turns, Thru moves only, Broadside ^<	Clear	Riverside Ave	T - Intersection	Dry
128919	March 11, 2015, 3:51 PM	US-7 Riverside Ave	Property Damage Only	No Turns, Thru moves only, Broadside ^<	Clear	Hillside Ter	T - Intersection	Dry
135032	July 8, 2015, 1:10 PM	Riverside Ave	Property Damage Only	Rear End	Clear	Hillside Drive	Not at a Junction	Dry
135866	July 27, 2015, 5:51 PM	US-7 Riverside Ave	Injury	Rear End	Clear	Hillside Ter	Not at a Junction	Dry
135855	July 28, 2015, 5:31 PM	Riverside Ave	Property Damage Only	Rear End	Clear	Hillside Terr	Not at a Junction	Dry
136731	August 18, 2015, 8:48 AM	Riverside Ave	Injury	No Turns, Thru moves only, Broadside ^<	Clear	Hillside Ter	Driveway	Dry
137378	September 1, 2015, 4:46 PM	Riverside Ave	Injury	No Turns, Thru moves only, Broadside ^<	Clear	Hillside Terr	Driveway	Dry
738237	December 29, 2015, 12:52 PM	Hillside Ter	Property Damage Only	Right Turn and Thru, Head On v^--	Freezing Precipitation	Riverside Ave	T - Intersection	Snow
738909	April 1, 2016, 7:09 PM	Riverside Ave	Injury	Left Turn and Thru, Angle Broadside -->v--	Clear	Hillside Ter	T - Intersection	Dry
731856	April 8, 2016, 12:15 PM	Riverside Ave	Property Damage Only	Left Turn and Thru, Angle Broadside -->v--	Cloudy	Hillside Terr	T - Intersection	Wet
721369	May 13, 2016, 11:02 AM	Hillside Terr	Injury	No Turns, Thru moves only, Broadside ^<	Rain	Riverside Ave	T - Intersection	Wet
809492	August 7, 2017, 4:25 PM	Riverside Ave	Property Damage Only	Opp Direction Sideswipe	Rain	Hillside Ter	Not at a Junction	Wet
1861094	August 31, 2017, 4:53 PM	Riverside Ave	Property Damage Only	Left Turn and Thru, Head On ^v--	Clear	Hillside Ave	T - Intersection	Dry
1859927	September 14, 2017, 1:55 PM	Riverside Ave	Property Damage Only	Rear End	Cloudy	Hillside Ter	Parking Lot	Dry
810819	November 9, 2017, 12:35 AM	Riverside Ave	Injury		Clear	Hillside Ter	Not at a Junction	Dry
1861549	December 6, 2017, 4:28 PM	Riverside Ave	Property Damage Only	Rear End	Clear	Hillside Terr	T - Intersection	Dry
1856443	May 12, 2018, 5:17 PM	Riverside Ave	Injury	Right Turn and Thru, Broadside ^<--	Clear	Hillside Dr	Driveway	Dry
1856858	July 31, 2018, 4:46 PM	Riverside Ave	Property Damage Only			Hillside Terr		
1856991	August 8, 2018, 7:45 AM	Riverside Ave	Property Damage Only			Hillside Ter		
1856659	September 2, 2018, 4:28 PM	Riverside Ave	Property Damage Only	Rear End	Clear	Hillside Ter	Not at a Junction	Dry



Appendix C

Trip Generation Summary

Trip Generation - Riverside Independent Living Facility

Total Site generated trips (not accounting for internal, pass-by, or diverted trips)

Site Land Uses and Descriptions			
Code	Land Use	Size	Unit
1	2	3	4
252	Senior Adult Housing - Attached	60	Dwelling Units

AM PK HR OF ADJACENT STREET TRAFFIC													
directional dist.		average				regression		# trips					
% enter	% exit	# studies	Avg Rate	Std Dev.	Total by Avg	r ²	total by Eq'n	Method Chosen	Total Trips	Entering	Exiting		
5	6	7	8	9	10	11	12	13	14				
35%	65%	11	0.20	0.05	12	0.98	12	Regression	12	4	8		

total				entering	exiting
AM Peak Hour Total Site Trips:				12	8

PM PK HR OF ADJACENT STREET TRAFFIC													
directional dist.		average				regression		# trips					
% enter	% exit	# studies	Avg Rate	Std Dev.	Total by Avg	r ²	total by Eq'n	Method Chosen	Total Trips	Entering	Exiting		
15	16	17	18	19	20	21	22	23	24				
55%	45%	11	0.26	0.08	16	0.96	17	Regression	17	9	8		

total				entering	exiting
PM Peak Hour Total Site Trips:				17	8



Appendix D

110 Riverside Avenue Traffic Impact Analysis

Introduction

The purpose of this Traffic Impact Analysis is to update previously identified potential traffic impacts relating to the proposed construction of a 57 unit apartment building on Riverside Avenue in Burlington, Vermont. A Traffic Impact Report was conducted in 2013 for the project, which has not yet been constructed. The project is located on the south side of Riverside Avenue on the site of the former M&H Auto building. Figure 1: *Location Map* illustrates the property location in relation to the street network in the immediate area. Updates included a comparison of 2013 versus current traffic volume, an updated design hour capacity analysis, and updated crash analysis.



Figure 1: Location Map

Existing Conditions

Riverside Avenue is classified by VTrans as an Urban Principal Arterial, and is also known as US Route 2/7 in this location. For the purpose of this report, Riverside Ave will be referred to as running east-west. There is a single lane of travel, plus a bike lane, in each direction. The speed limit is posted at 25 miles per hour (mph) and there is an advisory speed curve warning 25 mph posted in advance of the curve in both directions. A shared-use path is located on the north side of the road, and a concrete sidewalk runs along the project's frontage on the south side of the road from the west, terminating at the eastern property boundary. An annual average daily traffic (AADT) volume of 15,900 vehicles per day was recorded in 2018 at automatic traffic recorder (ATR) station S6D156, located 0.5 miles south (or west) of Colchester Avenue. The base AADT used in the 2013 traffic study was 15,000 vpd.

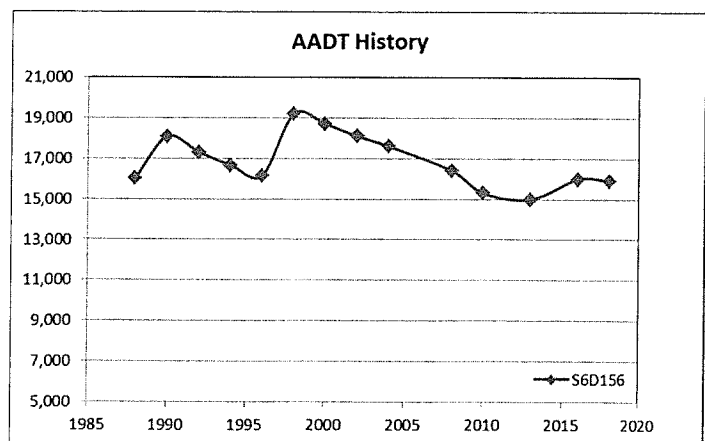
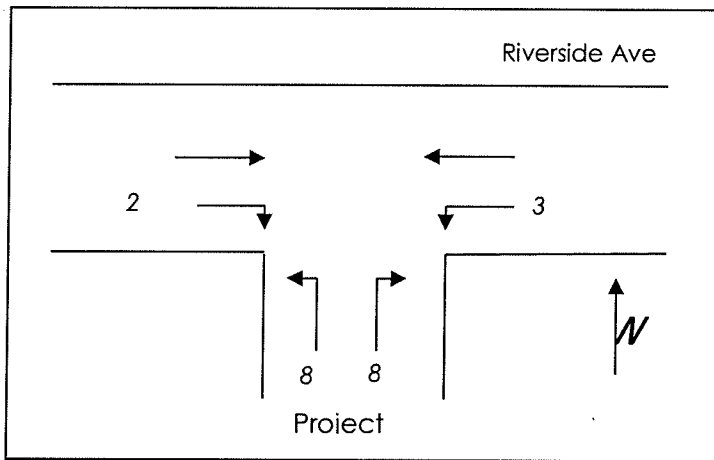


Figure 2: Riverside Ave Traffic History



Proposed trip distribution is based primarily on analogy to this short count. Projected traffic volumes in front of the site during morning and evening peak traffic hours are illustrated in the diagrams below.

Figure 3: AM Peak Traffic Distribution

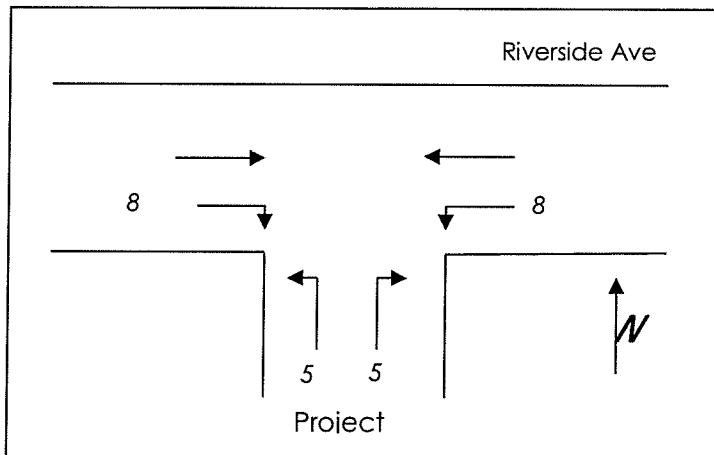


Figure 4: PM Peak Traffic Distribution

Level of Service Analysis – Project Driveway

A capacity analysis was performed on the intersection of the project driveway with Riverside Avenue. Because the PM Peak has a significantly higher hourly traffic volume than the AM peak (approx. 1900 vph PM Peak vs during 1150 vph AM Peak), only the PM Peak was analyzed. For analysis purposes, the eastern driveway was modeled with all of the traffic utilizing that entrance. It is anticipated that some of the right turning movements (ingress only) will take place at the western driveway. Level of Service (LOS) was calculated for the HCM2010 methodology. The HCM levels of service used in the analysis are based on control delay of critical movements and are summarized in the table below.

The table below identifies the northbound Riverside Avenue approach to the Barrett Street intersection for current traffic conditions, as identified in the Scoping Study. The distance between the intersection and the easternmost project driveway is approximately 750 feet. There are no conflicting crossings or driveways that are affected by this existing traffic queue, aside from the trailhead parking on the north side of Riverside Ave.

Table 4: Existing Conditions - Peak Hour Analysis

	Northbound Riverside Ave (through movement)
Traffic Volume	914 veh
Delay	65.6 s
LOS	E
Queue – 95th Percentile	572 ft
Queue – 50th Percentile	422 ft
Distance to new Drive	750 ft

The increase in traffic of 13 total trips at this intersection during the PM Peak represents less than 1% of total traffic, which is smaller than the limits of daily fluctuation in volume experienced by the intersection system.

Crash History – Project Driveway

The crash history for within a 0.2 mile (approximately 1000 ft) section of Riverside Avenue, centered on the proposed project was reviewed using the VTrans Crash Query. According to this listing, 13 crashes occurred during the five-year period between 2014 and 2018. A crash rate of 2.280 crashes per million vehicle miles (Cr/MVM) was calculated for the corridor. The critical rate calculated for Urban Principal Arterials in Vermont was noted as 7.551 Cr/MVM in the most recent Summary of Statewide Average Crash Rates, resulting in the section not being considered a high crash location.

While this section of the Riverside Ave Corridor would not be considered a High Crash Location, the adjacent intersection system includes the Colchester Ave/Barrett Street intersection, which is identified by VTrans as a High Crash Location.

Sight Distance

Sight distance measurements were taken on Riverside Avenue at the two driveway locations. The table below outlines the measured sight distance and the AASHTO recommended intersection and stopping sight distances.

Table 5: Sight Distance

		Measured 3/6/2013	Intersection Sight Distance ¹		Stopping Sight Distance
East Driveway	To East	342 ft	280 ft	-	155 ft
	To West	312* ft	-	240 ft	155 ft
West Driveway	To East	317 ft	280 ft	-	155 ft
	To West	676 ft	-	240 ft	155 ft

¹ Table 9-6, 9-8; A Policy on the Geometric Design of Highways and Streets, 2011, AASHTO.

intersection), and added striping for the inclusion of bicycle lanes. Several other non-pedestrian intersection improvements are recommended, including new pavement markings, protected left phase for southbound Colchester Avenue, right-turn arrow for southbound right turns, and advance lane designation signs.

The proposed project has a current Act 250 Permit (4C1282, 4C0282-1) in which they have a condition to pay a proportional fair-share monetary contribution toward the Colchester Ave/Riverside Ave/Barrett Street intersection improvements. Their contribution was calculated based on the projects proportion of overall traffic at the intersection and is in the amount of \$15,260, which is to be paid prior to commencement of construction. The Burlington City Council endorsed the Short Term and 4-Way intersection improvement alternatives outlined in the report in the spring of 2019 and the City is currently pursuing implementation of these measures.

Summary of Findings

Based on review and analysis of the existing and proposed traffic conditions, the following conclusions are presented.

1. Sisters and Brothers Investment Group is proposing the construction of a 57 unit apartment building to be located at 110 Riverside Avenue in Burlington. The property is located on the south side of the road, approximately 0.15 miles west of Colchester Avenue.
2. The project will have direct access to Riverside Avenue. The eastern driveway will allow both ingress and egress, while the west driveway movements will be limited to right-in only, for direct access to the parking garage. The new driveways will replace two existing curb cuts.
3. According to ITE Trip Generation, 10th Edition, the project is expected to generate approximately 21 new trips during the AM peak, with 5 entering and 16 exiting. During the afternoon peak, the project is estimated to generate 25 trips, 15 entering and 10 exiting. The project is located on a bus line.
4. The additional 25 trips on the road resulting from the proposed project represents 1.5% of total PM design hour traffic on Riverside Avenue. The proposed trip distribution will add 13 trips to the adjacent Riverside/Barrett St intersection, an increase of just over 0.5%.
5. Level of service on Riverside Ave at the new driveway intersection is calculated as a B during the PM peak hours. Level of service at the project access will be an E (40 seconds delay) during the PM peak hour. Excessive queuing is not anticipated at the project driveway due to the low number of exiting vehicles.
6. It is estimated that the proposed project will add approximately 5 vehicles to northbound Riverside Ave at the Barrett Street/Colchester Ave intersection, and 6 vehicle trips to southbound Riverside Ave during the PM Peak. This increase is just over



Appendix E

Intersection Capacity Analysis

HCM Unsignalized Intersection Capacity Analysis

6: Hillside Terrace West & Riverside Ave











01/06/2020

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Traffic Volume (veh/h)	576	5	0	694	4	0
Future Volume (Veh/h)	576	5	0	694	4	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	576	5	0	694	4	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	1288			325		
pX, platoon unblocked					0.78	
vC, conflicting volume			581		1272	578
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			581		1207	578
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		97	100
cM capacity (veh/h)			993		157	515
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	581	694	4			
Volume Left	0	0	4			
Volume Right	5	0	0			
cSH	1700	993	157			
Volume to Capacity	0.34	0.00	0.03			
Queue Length 95th (ft)	0	0	2			
Control Delay (s)	0.0	0.0	28.5			
Lane LOS			D			
Approach Delay (s)	0.0	0.0	28.5			
Approach LOS			D			
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			46.5%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

9: Hillside Terrace East & Riverside Ave

01/06/2020

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	572	11	7	669	26	43
Future Volume (vph)	572	11	7	669	26	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1858		1770	1863	1674	
Flt Permitted	1.00		0.36	1.00	0.98	
Satd. Flow (perm)	1858		670	1863	1674	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	572	11	7	669	26	43
RTOR Reduction (vph)	1	0	0	0	35	0
Lane Group Flow (vph)	582	0	7	669	34	0
Turn Type	NA		Perm	NA	Prot	
Protected Phases	2			6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.4		55.4	55.4	16.1	
Effective Green, g (s)	55.4		55.4	55.4	16.1	
Actuated g/C Ratio	0.63		0.63	0.63	0.18	
Clearance Time (s)	5.0		5.0	5.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1169		421	1172	306	
v/s Ratio Prot	0.31			c0.36	c0.02	
v/s Ratio Perm			0.01			
v/c Ratio	0.50		0.02	0.57	0.11	
Uniform Delay, d1	8.8		6.1	9.4	30.0	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	1.5		0.0	0.7	0.7	
Delay (s)	10.3		6.1	10.1	30.7	
Level of Service	B		A	B	C	
Approach Delay (s)	10.3			10.1	30.7	
Approach LOS	B			B	C	
Intersection Summary						
HCM 2000 Control Delay			11.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.45			
Actuated Cycle Length (s)			88.0		Sum of lost time (s)	14.0
Intersection Capacity Utilization			46.8%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

6: Hillside Terrace West & Riverside Ave

01/06/2020

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Traffic Volume (veh/h)	918	5	0	793	3	7
Future Volume (Veh/h)	918	5	0	793	3	7
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	918	5	0	793	3	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	1288			325		
pX, platoon unblocked					0.71	
vC, conflicting volume			923		1714	920
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			923		1802	920
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		95	98
cM capacity (veh/h)			740		62	328
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	923	793	10			
Volume Left	0	0	3			
Volume Right	5	0	7			
cSH	1700	740	143			
Volume to Capacity	0.54	0.00	0.07			
Queue Length 95th (ft)	0	0	6			
Control Delay (s)	0.0	0.0	32.0			
Lane LOS			D			
Approach Delay (s)	0.0	0.0	32.0			
Approach LOS			D			
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			58.6%	ICU Level of Service		B
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

9: Hillside Terrace East & Riverside Ave

01/06/2020

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰		↱	↰	↱	
Traffic Volume (vph)	805	25	41	780	19	26
Future Volume (vph)	805	25	41	780	19	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1855		1770	1863	1682	
Flt Permitted	1.00		0.21	1.00	0.98	
Satd. Flow (perm)	1855		386	1863	1682	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	805	25	41	780	19	26
RTOR Reduction (vph)	1	0	0	0	21	0
Lane Group Flow (vph)	829	0	41	780	24	0
Turn Type	NA		Perm	NA	Prot	
Protected Phases	2			6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.4		55.4	55.4	16.1	
Effective Green, g (s)	55.4		55.4	55.4	16.1	
Actuated g/C Ratio	0.63		0.63	0.63	0.18	
Clearance Time (s)	5.0		5.0	5.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1167		243	1172	307	
v/s Ratio Prot	c0.45			0.42	c0.01	
v/s Ratio Perm			0.11			
v/c Ratio	0.71		0.17	0.67	0.08	
Uniform Delay, d1	10.9		6.8	10.4	29.8	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	3.7		0.3	1.4	0.5	
Delay (s)	14.6		7.1	11.8	30.3	
Level of Service	B		A	B	C	
Approach Delay (s)	14.6			11.6	30.3	
Approach LOS	B			B	C	
Intersection Summary						
HCM 2000 Control Delay			13.6		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.55			
Actuated Cycle Length (s)			88.0		Sum of lost time (s)	14.0
Intersection Capacity Utilization			54.7%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

6: Hillside Terrace West & Riverside Ave











01/06/2020

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↗	
Traffic Volume (veh/h)	576	7	2	694	11	0
Future Volume (Veh/h)	576	7	2	694	11	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	576	7	2	694	11	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)	1288			325		
pX, platoon unblocked					0.77	
vC, conflicting volume			583		1278	580
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			583		1213	580
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		93	100
cM capacity (veh/h)			991		155	515
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	583	696	11			
Volume Left	0	2	11			
Volume Right	7	0	0			
cSH	1700	991	155			
Volume to Capacity	0.34	0.00	0.07			
Queue Length 95th (ft)	0	0	6			
Control Delay (s)	0.0	0.1	30.0			
Lane LOS		A	D			
Approach Delay (s)	0.0	0.1	30.0			
Approach LOS			D			
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			48.1%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

9: Hillside Terrace East & Riverside Ave










01/06/2020

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	572	11	7	671	26	43
Future Volume (vph)	572	11	7	671	26	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1858		1770	1863	1674	
Flt Permitted	1.00		0.36	1.00	0.98	
Satd. Flow (perm)	1858		670	1863	1674	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	572	11	7	671	26	43
RTOR Reduction (vph)	1	0	0	0	35	0
Lane Group Flow (vph)	582	0	7	671	34	0
Turn Type	NA		Perm	NA	Prot	
Protected Phases	2			6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.4		55.4	55.4	16.1	
Effective Green, g (s)	55.4		55.4	55.4	16.1	
Actuated g/C Ratio	0.63		0.63	0.63	0.18	
Clearance Time (s)	5.0		5.0	5.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1169		421	1172	306	
v/s Ratio Prot	0.31			c0.36	c0.02	
v/s Ratio Perm			0.01			
v/c Ratio	0.50		0.02	0.57	0.11	
Uniform Delay, d1	8.8		6.1	9.4	30.0	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	1.5		0.0	0.7	0.7	
Delay (s)	10.3		6.1	10.1	30.7	
Level of Service	B		A	B	C	
Approach Delay (s)	10.3			10.1	30.7	
Approach LOS	B			B	C	
Intersection Summary						
HCM 2000 Control Delay			11.3		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.45			
Actuated Cycle Length (s)			88.0		Sum of lost time (s)	14.0
Intersection Capacity Utilization			46.9%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

22: Hillside Terrace West & Site Driveway










01/06/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	7	4	0	4	5
Future Volume (Veh/h)	0	7	4	0	4	5
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	7	4	0	4	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	17	4			4	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	17	4			4	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			100	
cM capacity (veh/h)	999	1080			1618	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	7	4	9			
Volume Left	0	0	4			
Volume Right	7	0	0			
cSH	1080	1700	1618			
Volume to Capacity	0.01	0.00	0.00			
Queue Length 95th (ft)	0	0	0			
Control Delay (s)	8.4	0.0	3.2			
Lane LOS	A		A			
Approach Delay (s)	8.4	0.0	3.2			
Approach LOS	A					
Intersection Summary						
Average Delay		4.4				
Intersection Capacity Utilization		13.8%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

6: Hillside Terrace West & Riverside Ave

01/31/2020

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	918	10	4	793	6	12
Future Volume (Veh/h)	918	10	4	793	6	12
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	918	10	4	793	6	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh						
Upstream signal (ft)	1288			325		
pX, platoon unblocked					0.70	
vC, conflicting volume			928		1724	923
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			928		1818	923
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		90	96
cM capacity (veh/h)			737		60	327
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	928	797	18			
Volume Left	0	4	6			
Volume Right	10	0	12			
cSH	1700	737	131			
Volume to Capacity	0.55	0.01	0.14			
Queue Length 95th (ft)	0	0	12			
Control Delay (s)	0.0	0.2	36.7			
Lane LOS		A	E			
Approach Delay (s)	0.0	0.2	36.7			
Approach LOS			E			
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			58.9%	ICU Level of Service	B	
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

9: Hillside Terrace East & Riverside Ave










01/31/2020

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰		↰	↰	↰	
Traffic Volume (vph)	810	25	41	784	19	26
Future Volume (vph)	810	25	41	784	19	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1855		1770	1863	1682	
Flt Permitted	1.00		0.20	1.00	0.98	
Satd. Flow (perm)	1855		381	1863	1682	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	810	25	41	784	19	26
RTOR Reduction (vph)	1	0	0	0	21	0
Lane Group Flow (vph)	834	0	41	784	24	0
Turn Type	NA		Perm	NA	Prot	
Protected Phases	2			6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.4		55.4	55.4	16.1	
Effective Green, g (s)	55.4		55.4	55.4	16.1	
Actuated g/C Ratio	0.63		0.63	0.63	0.18	
Clearance Time (s)	5.0		5.0	5.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1167		239	1172	307	
v/s Ratio Prot	c0.45			0.42	c0.01	
v/s Ratio Perm			0.11			
v/c Ratio	0.71		0.17	0.67	0.08	
Uniform Delay, d1	11.0		6.8	10.4	29.8	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	3.8		0.3	1.5	0.5	
Delay (s)	14.7		7.1	11.9	30.3	
Level of Service	B		A	B	C	
Approach Delay (s)	14.7			11.7	30.3	
Approach LOS	B			B	C	
Intersection Summary						
HCM 2000 Control Delay			13.7		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.55			
Actuated Cycle Length (s)			88.0		Sum of lost time (s)	14.0
Intersection Capacity Utilization			55.0%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

22: Hillside Terrace West & Site Driveway

01/31/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	8	10	0	9	5
Future Volume (Veh/h)	0	8	10	0	9	5
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	8	10	0	9	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	33	10			10	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	33	10			10	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			99	
cM capacity (veh/h)	975	1071			1610	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	8	10	14			
Volume Left	0	0	9			
Volume Right	8	0	0			
cSH	1071	1700	1610			
Volume to Capacity	0.01	0.01	0.01			
Queue Length 95th (ft)	1	0	0			
Control Delay (s)	8.4	0.0	4.7			
Lane LOS	A		A			
Approach Delay (s)	8.4	0.0	4.7			
Approach LOS	A					
Intersection Summary						
Average Delay			4.1			
Intersection Capacity Utilization			17.4%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

6: Hillside Terrace West & Riverside Ave

01/06/2020

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↱	↘↗	
Traffic Volume (veh/h)	593	5	0	715	4	0
Future Volume (Veh/h)	593	5	0	715	4	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	593	5	0	715	4	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)	1288		325			
pX, platoon unblocked			0.76			
vC, conflicting volume			598	1310	596	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			598	1252	596	
tC, single (s)			4.1	6.4	6.2	
tC, 2 stage (s)						
tF (s)			2.2	3.5	3.3	
p0 queue free %			100	97	100	
cM capacity (veh/h)			979	145	504	
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	598	715	4			
Volume Left	0	0	4			
Volume Right	5	0	0			
cSH	1700	979	145			
Volume to Capacity	0.35	0.00	0.03			
Queue Length 95th (ft)	0	0	2			
Control Delay (s)	0.0	0.0	30.5			
Lane LOS						
Approach Delay (s)	0.0	0.0	30.5			
Approach LOS						
D						
Intersection Summary						
Average Delay						
			0.1			
Intersection Capacity Utilization			47.6%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

9: Hillside Terrace East & Riverside Ave










01/06/2020

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↗		↖	↗	↖	
Traffic Volume (vph)	590	12	7	689	27	44
Future Volume (vph)	590	12	7	689	27	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1858		1770	1863	1675	
Flt Permitted	1.00		0.35	1.00	0.98	
Satd. Flow (perm)	1858		647	1863	1675	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	590	12	7	689	27	44
RTOR Reduction (vph)	1	0	0	0	36	0
Lane Group Flow (vph)	601	0	7	689	35	0
Turn Type	NA		Perm	NA	Prot	
Protected Phases	2			6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.4		55.4	55.4	16.1	
Effective Green, g (s)	55.4		55.4	55.4	16.1	
Actuated g/C Ratio	0.63		0.63	0.63	0.18	
Clearance Time (s)	5.0		5.0	5.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1169		407	1172	306	
v/s Ratio Prot	0.32			c0.37	c0.02	
v/s Ratio Perm			0.01			
v/c Ratio	0.51		0.02	0.59	0.11	
Uniform Delay, d1	8.9		6.1	9.6	30.0	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	1.6		0.0	0.8	0.8	
Delay (s)	10.5		6.1	10.3	30.8	
Level of Service	B		A	B	C	
Approach Delay (s)	10.5			10.3	30.8	
Approach LOS	B			B	C	
Intersection Summary						
HCM 2000 Control Delay			11.5		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.46			
Actuated Cycle Length (s)			88.0		Sum of lost time (s)	14.0
Intersection Capacity Utilization			48.0%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

6: Hillside Terrace West & Riverside Ave











01/06/2020

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	945	5	0	816	3	7
Future Volume (Veh/h)	945	5	0	816	3	7
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	945	5	0	816	3	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage (veh)						
Upstream signal (ft)	1288		325			
pX, platoon unblocked					0.69	
vC, conflicting volume			950		1764	948
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			950		1882	948
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		94	98
cM capacity (veh/h)			723		54	316
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	950	816	10			
Volume Left	0	0	3			
Volume Right	5	0	7			
cSH	1700	723	128			
Volume to Capacity	0.56	0.00	0.08			
Queue Length 95th (ft)	0	0	6			
Control Delay (s)	0.0	0.0	35.4			
Lane LOS						
Approach Delay (s)	0.0	0.0	35.4			
Approach LOS						
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			60.0%	ICU Level of Service		B
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

9: Hillside Terrace East & Riverside Ave

01/06/2020

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	829	26	42	803	20	27
Future Volume (vph)	829	26	42	803	20	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1855		1770	1863	1682	
Flt Permitted	1.00		0.19	1.00	0.98	
Satd. Flow (perm)	1855		359	1863	1682	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	829	26	42	803	20	27
RTOR Reduction (vph)	1	0	0	0	22	0
Lane Group Flow (vph)	854	0	42	803	25	0
Turn Type	NA		Perm	NA	Prot	
Protected Phases	2			6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.4		55.4	55.4	16.1	
Effective Green, g (s)	55.4		55.4	55.4	16.1	
Actuated g/C Ratio	0.63		0.63	0.63	0.18	
Clearance Time (s)	5.0		5.0	5.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1167		226	1172	307	
v/s Ratio Prot	c0.46			0.43	c0.01	
v/s Ratio Perm			0.12			
v/c Ratio	0.73		0.19	0.69	0.08	
Uniform Delay, d1	11.2		6.8	10.6	29.8	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	4.1		0.4	1.7	0.5	
Delay (s)	15.3		7.2	12.3	30.3	
Level of Service	B		A	B	C	
Approach Delay (s)	15.3			12.0	30.3	
Approach LOS	B			B	C	
Intersection Summary						
HCM 2000 Control Delay			14.1		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.57			
Actuated Cycle Length (s)			88.0		Sum of lost time (s)	14.0
Intersection Capacity Utilization			56.0%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

6: Hillside Terrace West & Riverside Ave

01/06/2020

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰			↱	↰	↱
Traffic Volume (veh/h)	593	7	2	715	11	0
Future Volume (Veh/h)	593	7	2	715	11	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	593	7	2	715	11	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (ft)	1288			325		
pX, platoon unblocked					0.76	
vC, conflicting volume			600		1316	596
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			600		1258	596
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		92	100
cM capacity (veh/h)			977		144	503
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	600	717	11			
Volume Left	0	2	11			
Volume Right	7	0	0			
cSH	1700	977	144			
Volume to Capacity	0.35	0.00	0.08			
Queue Length 95th (ft)	0	0	6			
Control Delay (s)	0.0	0.1	32.2			
Lane LOS		A	D			
Approach Delay (s)	0.0	0.1	32.2			
Approach LOS			D			
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			49.2%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

9: Hillside Terrace East & Riverside Ave










01/06/2020

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↰		↰	↰	↰	
Traffic Volume (vph)	590	12	7	691	27	44
Future Volume (vph)	590	12	7	691	27	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1858		1770	1863	1675	
Flt Permitted	1.00		0.35	1.00	0.98	
Satd. Flow (perm)	1858		647	1863	1675	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	590	12	7	691	27	44
RTOR Reduction (vph)	1	0	0	0	36	0
Lane Group Flow (vph)	601	0	7	691	35	0
Turn Type	NA		Perm	NA	Prot	
Protected Phases	2			6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.4		55.4	55.4	16.1	
Effective Green, g (s)	55.4		55.4	55.4	16.1	
Actuated g/C Ratio	0.63		0.63	0.63	0.18	
Clearance Time (s)	5.0		5.0	5.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1169		407	1172	306	
v/s Ratio Prot	0.32			c0.37	c0.02	
v/s Ratio Perm			0.01			
v/c Ratio	0.51		0.02	0.59	0.11	
Uniform Delay, d1	8.9		6.1	9.6	30.0	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	1.6		0.0	0.8	0.8	
Delay (s)	10.5		6.1	10.4	30.8	
Level of Service	B		A	B	C	
Approach Delay (s)	10.5			10.3	30.8	
Approach LOS	B			B	C	
Intersection Summary						
HCM 2000 Control Delay			11.5		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.47			
Actuated Cycle Length (s)			88.0		Sum of lost time (s)	14.0
Intersection Capacity Utilization			48.1%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

22: Hillside Terrace West & Site Driveway











01/06/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	7	4	0	4	5
Future Volume (Veh/h)	0	7	4	0	4	5
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	7	4	0	4	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	17	4			4	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	17	4			4	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			100	
cM capacity (veh/h)	999	1080			1618	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	7	4	9			
Volume Left	0	0	4			
Volume Right	7	0	0			
cSH	1080	1700	1618			
Volume to Capacity	0.01	0.00	0.00			
Queue Length 95th (ft)	0	0	0			
Control Delay (s)	8.4	0.0	3.2			
Lane LOS	A		A			
Approach Delay (s)	8.4	0.0	3.2			
Approach LOS	A					
Intersection Summary						
Average Delay			4.4			
Intersection Capacity Utilization			13.8%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

6: Hillside Terrace West & Riverside Ave

01/31/2020

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	935	10	4	816	6	12
Future Volume (Veh/h)	935	10	4	816	6	12
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	935	10	4	816	6	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None		None			
Median storage veh						
Upstream signal (ft)	1288		325			
pX, platoon unblocked					0.69	
vC, conflicting volume			945		1764	940
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			945		1884	940
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		89	96
cM capacity (veh/h)			726		53	320
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	945	820	18			
Volume Left	0	4	6			
Volume Right	10	0	12			
cSH	1700	726	120			
Volume to Capacity	0.56	0.01	0.15			
Queue Length 95th (ft)	0	0	13			
Control Delay (s)	0.0	0.2	40.4			
Lane LOS			A	E		
Approach Delay (s)	0.0	0.2	40.4			
Approach LOS			E			
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			59.8%	ICU Level of Service		B
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

9: Hillside Terrace East & Riverside Ave










01/31/2020

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→	→	←	←	←	←
Traffic Volume (vph)	834	26	42	807	20	27
Future Volume (vph)	834	26	42	807	20	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	4.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.92	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	1855		1770	1863	1682	
Flt Permitted	1.00		0.19	1.00	0.98	
Satd. Flow (perm)	1855		353	1863	1682	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	834	26	42	807	20	27
RTOR Reduction (vph)	1	0	0	0	22	0
Lane Group Flow (vph)	859	0	42	807	25	0
Turn Type	NA		Perm	NA	Prot	
Protected Phases	2			6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.4		55.4	55.4	16.1	
Effective Green, g (s)	55.4		55.4	55.4	16.1	
Actuated g/C Ratio	0.63		0.63	0.63	0.18	
Clearance Time (s)	5.0		5.0	5.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1167		222	1172	307	
v/s Ratio Prot	c0.46			0.43	c0.01	
v/s Ratio Perm			0.12			
v/c Ratio	0.74		0.19	0.69	0.08	
Uniform Delay, d1	11.3		6.9	10.7	29.8	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	4.2		0.4	1.7	0.5	
Delay (s)	15.4		7.3	12.4	30.3	
Level of Service	B		A	B	C	
Approach Delay (s)	15.4			12.1	30.3	
Approach LOS	B			B	C	
Intersection Summary						
HCM 2000 Control Delay			14.2		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.57			
Actuated Cycle Length (s)			88.0		Sum of lost time (s)	14.0
Intersection Capacity Utilization			56.3%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

22: Hillside Terrace West & Site Driveway

01/31/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	8	10	0	9	5
Future Volume (Veh/h)	0	8	10	0	9	5
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	8	10	0	9	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	33	10			10	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	33	10			10	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	99			99	
cM capacity (veh/h)	975	1071			1610	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	8	10	14			
Volume Left	0	0	9			
Volume Right	8	0	0			
cSH	1071	1700	1610			
Volume to Capacity	0.01	0.01	0.01			
Queue Length 95th (ft)	1	0	0			
Control Delay (s)	8.4	0.0	4.7			
Lane LOS	A		A			
Approach Delay (s)	8.4	0.0	4.7			
Approach LOS	A					
Intersection Summary						
Average Delay			4.1			
Intersection Capacity Utilization			17.4%	ICU Level of Service		A
Analysis Period (min)			15			